

NEW SCYPHOZOAN RECORDS FOR HAWAII:  
*ANOMALORHIZA SHAWI* LIGHT, 1921, AND  
*THYSANOSTOMA LORIFERUM* (Ehrenberg, 1835);  
WITH NOTES ON SEVERAL OTHER RHIZOSTOMES

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*Abstract.*—Several adult specimens of the scyphomedusa *Anomalorhiza shawi*, unknown since the original collections in the Philippines during the 1920's, have recently been collected in Hawaii. An adult specimen of the wide ranging oceanic species, *Thysanostoma loriferum*, previously collected from the Red Sea to the western Pacific, has also been collected in Hawaii. *Anomalorhiza shawi* is believed to be the latest example of several neritic scyphozoans introduced into Hawaii from the western Pacific. An earlier introduction, a *Mastigias* close to *M. papua*, was misidentified as *Thysanostoma flagellatum* in a recent handbook.

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Recent collections in Hawaii of two rhizostome medusae, *Anomalorhiza shawi* Light, 1921, and *Thysanostoma loriferum* (Ehrenberg, 1835), have increased the number of rhizostome species known from the central Pacific. This note records their collection, suggests the mode of introduction for *A. shawi*, and clarifies some previously published errors in the literature.

*Anomalorhiza shawi* was described by S. F. Light (1921) on the basis of two complete specimens collected from Manila Bay, Philippine Islands. There are only two subsequent mentions of the species: Stiasny (1924) referred it to *Lychnorhiza*; Kramp (1961) maintained it in *Anomalorhiza*. Apparently there are no published collection records other than from the original location.

The oceanic genus *Thysanostoma* was known from Hawaii on the basis of several Nineteenth Century collections of *T. flagellatum* (Haeckel, 1880). A recent *T. loriferum* collection established the presence of two species in the Hawaiian fauna.

The medusa figured in Devaney and Eldredge (1977, figs. 8, 9) as "(?)*Thysanostoma flagellatum*" is actually a *Mastigias* close to *M. papua* (as figured by Hamner 1982).

*Anomalorhiza shawi* Light, 1921

Fig. 1

*Material examined.*—One adult specimen collected 27 Apr 1983 by J. Brock from beach at northeast side of Coconut (Moku O Loe) Island, Kaneohe Bay, Oahu (21°26'18.5"N, 157°47'23"W). Accession 830004HA/1 Processing Center, Naval Ocean Systems Center-Hawaii Laboratory (NOSC).

Two adult specimens collected 6 Jan 1984 by D. Krupp from lagoon on southwest side of Coconut Island (21°26'10"N, 157°47'34"W). Accession 830004HA/2 Processing Center, NOSC.

*Description.*—The specimens range from 50 cm to 87 cm in diameter. The

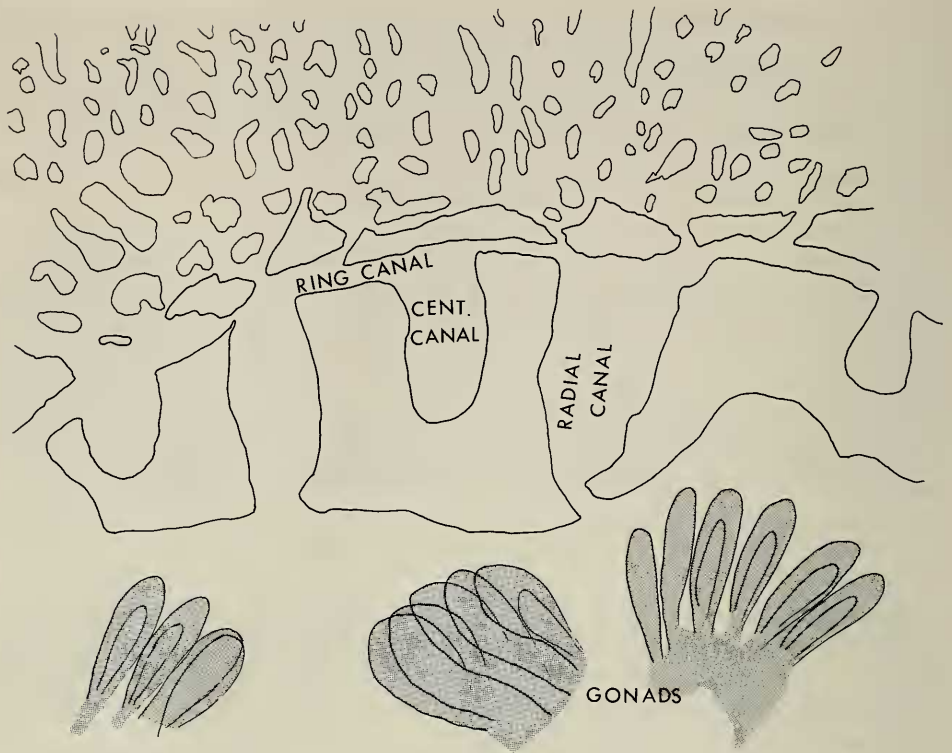


Fig. 1. *Anomalorhiza shawi* canal system (traced from a color transparency) showing canal system in subumbrellar view and the gonads. Cent. Canal, centripedal canal between the radial canals. Rhopalial radial canal is indistinguishable within the anastomosing marginal canal; inter-rhopalial radial canal constricted at its inner end.

exumbrella of the clear, fragile bell is marked by numerous low, warty bumps, each ringed with a light chocolate brown set against a general light purple ground color. The mouth arms are a deep purple while the gonads are a lighter pink-purple. No zooxanthellae were seen in examination of the bell and mouth arms. The single blind centripedal canal between each radial canal is especially obvious and clearly separates this species from all other daktyliophorans. The very complete original description is amended and extended only slightly as follows.

Light's (1921, fig. 2) rhopalial radial canals were distinguishable beyond the ring canal, but in one specimen some are indistinguishable from the general anastomosing marginal canal (Fig. 1). The present specimens have several thick brownish filaments on the subumbrellar surface between the mouth arms where Light (1921) mentions, "small, very slender threadlike filaments." The mouth arms of the present specimen are unbranched for about  $\frac{2}{3}$  ( $66\% \pm 2\%$ ,  $n = 9$ ; 95% limits) of their total length (excluding terminal filament), while Light's smaller and larger specimens were unbranched for 71% and 82% respectively. (Most terminal filaments on the present specimens had lost their club-shaped distal part.)

The cnidome of the species is unexceptional with ovoid "a" atrichs, 4–6  $\mu\text{m}$  by 3–4  $\mu\text{m}$ ; small heterotrichous microbasic euryteles, 7–9  $\mu\text{m}$  by 6–7  $\mu\text{m}$ ; and almost spherical holotrichous isorhizas 10–11  $\mu\text{m}$  by 9–10  $\mu\text{m}$  (live, undischarged measurements). No large "A" atrichs (Weill 1934), polyspira atrichs (Spangenberg 1964), or " $\alpha$ " atrichs (Calder 1971) were seen. The stinging potential of this species seems low as several test subjects (including the author) experienced no pain or redness when live mouth-arm fragments were rubbed on the skin of the inner wrist.

*Thysanostoma loriferum* (Ehrenberg, 1835)

Fig. 2

*Rhizostoma lorifera* Ehrenberg, 1835:260.

*Himanostoma lorifera*.—Haeckel, 1880:628, (additional bibliography see Kramp, 1961).

*Lorifera arabica* Haeckel, 1880:628.

*Lorifera lorifera*.—Mayer, 1910:694 (additional bibliography see Kramp, 1961).

*Thysanostoma lorifera*.—Stiasny, 1940:24.

*Thysanostoma loriferum*.—Kramp, 1961:364.

*Material examined*.—One adult specimen collected 5 Nov 1982 by M. Morioka, Waikiki Aquarium from Kuuloa Beach Park (21°30'43"N, 157°50'16"W) Oahu, Hawaii. Accession 830010HA, Processing Center, NOSC.

*Description*.—The specimen (Fig. 2) is 18 cm in diameter with a quite stiff, low-hemispherical bell of uniform pink-purple color. The ex-umbrellar surface is smooth. The broadly rounded marginal lappets are united by a thin common membrane. Each lappet pair is a darker purple than the purple of the exumbrella of the bell, from which it is delineated by a clear translucent circumferential band. The rhopalia and rhopaliar lappets are transparent and colorless.

The circumferential bell muscles are well developed, clearly visible in sub-umbrellar view. The canal system is very finely meshed, with radial and perradial rhopaliar canals clearly distinguishable.

The subumbrellar surface is smooth and translucent white. The subgenital ostia are approximately twice as broad as the mouth-arm pillars which are also translucent white. The barely developed gonads in the present specimen are light pink.

Distal parts of mouth arms were lost in present specimen. Their central stem is dark purple with fringes very dark (almost black) purple in life, fading to white in preserved material.

This species has a cnidome of ovoid "a" atrichs 4–5  $\mu\text{m}$  by 3–4  $\mu\text{m}$ , small heterotrichous microbasic euryteles, 6–8  $\mu\text{m}$  by 5–6  $\mu\text{m}$  and almost spherical holotrichous isorhizas, 8–10  $\mu\text{m}$  by 8–9  $\mu\text{m}$  (formalin preserved, undischarged measurements).

*Thysanostoma loriferum* is differentiated from *T. flagellatum* (Haeckel, 1880) by having marginal lappets united into a membrane, and a short terminal filament on each mouth arm. The original description of *T. flagellatum* by Haeckel (1880) was quite short and had no figure. Stiasny (1940) provided clear diagnoses of both based on comparative material as well as detailing their color differences. Figure 2 clearly shows the lash-like weakly frilled nature of the mouth arms which



Fig. 2. *Thysanostoma loriferum* showing the bell margin and the proximal portions of the mouth-arms. Note the characteristic sparse fringing along the edges of the mouth-arms. (Original photo a color transparency courtesy Mr. L. Matsuura, Waikiki Aquarium.)

distinguishes the Thysanostomatidae from all other rhizostomes. The endings *-ferum* and *-latum* agree (after Kramp 1961) in neuter gender with the generic name.

#### Discussion

Including the present species, there are now eight species of rhizostome medusae recorded from Hawaiian waters (Devaney and Eldredge 1977). Of these, *Cephea cephea* (Forskål, 1775), *T. flagellatum* (Haeckel, 1880) and *T. loriferum* (Ehrenberg, 1835) are oceanic species capable of reaching Hawaii as adult medusae.

*Thysanostoma flagellatum* has been collected on only two occasions from Hawaii (Haeckel 1880), but rather often (Kramp 1961) from the western Pacific (Philippines, Malaysian Archipelago). *Thysanostoma loriferum* had previously been recorded from the Red Sea to the western Pacific so its presence in Hawaii is not unexpected. It is probable that these oceanic species occur infrequently in Hawaii under favorable conditions but are more commonly seen in the island groups to the west and south.

A different situation exists with the remaining rhizostome species whose morphology and habits suggest ecological restriction to plankton-rich, quiet neritic waters with little likelihood of transoceanic migration by adult medusae. Clearly,



the two *Cassiopea* species, *C. medusa* Light, 1914 and *C. mertensii* Brandt, 1835, with their pseudobenthic habits are the most improbable adult immigrants. Scyphistomal introduction from the Philippines has been suggested (Cutress in Doty 1961) for *C. medusa* and the species identified as *Phyllorhiza punctata* von Lendenfeld, 1884, in Devaney and Eldredge (1977, fig. 7). This medusa has also been identified as *Cotylorhizoides pacificus* by Cutress (in Doty 1961), as *Phyllorhiza pacifica* by Cutress (in Mansueti 1963), as *Mastigias ocellatus* by Walsh (1967), and *M. papua* by Reed (1971; fig. 14). It is quite clearly a mastigid, as is the species identified as "(?) *Thysanostoma flagellatum* (Haeckel, 1880)" in Devaney and Eldredge (1977, figs. 8, 9). Quite similar mastigids are well figured in Faulkner (1970 p. 20) and Hamner (1982:264, 276, 277). Reexamination of the numerous species in the Mastigiidae on a world-wide basis is clearly imperative, thus any attempt at more precise identifications of these two forms would be unwise. Clearly these mastigids (as well as *C. mertensii*) are also likely candidates for scyphistomal introduction as all are rather fragile-bodied species commonly found in lagoons and shallows.

All of these species are now much less abundant than they were several years ago, but they are still believed to be present in the fauna.

*Anomalorhiza shawi*, with its large distinctive medusa is also a recent introduction. Personal observations and discussions with long-time fishermen and others with several decades of experience in Kaneohe Bay confirmed that this medusa was not seen before 1983. The medusa is quite fragile, tearing and breaking under even gentle tension, and would be unable physically to withstand the forces of the open ocean. This fact and the collections and numerous other observations all in the sheltered waters of Kaneohe Bay reinforce the conclusion of a neritic or estuarine habitat for the species. In this case, introduction by scyphistome in fouling communities transported from the Philippines to Hawaii is the most probable route of introduction. The presence of these adult specimens suggests the potential for permanent establishment should they be able to breed successfully.

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